

# Reproduction and biological characteristic of *Chouioia cunea*

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**Abstract:** *Chouioia cunea* Yang is a natural enemy for many kinds of crop and forest pests, particularly for *Hyphantria cunea* Drury, which is an international quarantine pest. The experiment of rearing *Chouioia cunea* with Tussah (Silkworm) pupa were carried out by "three-cut method" and inoculating method. The results showed that three-cut method is effective way for breeding *Chouioia cunea*, with a parasitism rate of 95%. The biological characteristics and the life cycle of *Chouioia cunea* were observed and described and more hosts of *Chouioia cunea* were found. "Three-cut method" as a new technique of rearing *Chouioia cunea* has been put into practice.

**Keywords:** *Chouioia cunea*; Rearing method; Pest control; *Hyphantria cunea*

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## Introduction

In the last two decades, the Integrated Pest Management (IPM) technology has been widely accepted and put into practice by more and more agro-forestry scientists. Biological control is an efficient method and a key part of IPM. *Chouioia cunea* Yang, a natural enemy of many kinds of crop and forest pests, has been found in Liaoning, Hebei, Shandong, Shanxi provinces and Shanghai in China. In Shenyang, it was firstly found on the pupa of American white fallworm (*Hyphantria cunea* Drury) and successfully inoculated on the tussah worm pupa (Wang 1992, 1994). American white fallworm is an international quarantine pest. In China the earliest report of this pest was in Dandong City, Liaoning Province in 1979. It has wide food range, reproduces rapidly, and causes serious damage to agriculture and forestry production.

Our early study has demonstrated that *Chouioia cunea* can parasitize many kinds of crop and forest pests, such as *Hyphantria cunea* Drury, *Ostrinia furnacalis*, *Heliethus armigera*, *Dendrolimus spectabilis*, *Antheraea pernyi guerini*, and so on (Wang 1997) (see Table 1). This paper makes further study on the biological characteristics and breeding method of *Chouioia cunea*, so as to bring this parasitism insect into full play in the biological control of pests.

## Materials and methods

### Source of *Chouioia cunea*

The overwintering pupae of American white fallworm were collected from forest field in spring and reared suc-

cessfully in the natural condition for obtaining *Chouioia cunea*. The pupa is big, strong, and more energetic, with long life span.

### Host tested

Tussah (Silkworm) pupa, pines caterpillar and willow moth were used as hosts.

### Breeding method

"Three-Cut-method" was used for breeding *Chouioia cunea* to obtain good quality host pupa not being infected by the bacteria, fungi and soft particle disease. We cut tree holes on the cocoon using a sharp knife (Fig. 1), and then carefully observe the inside of the cocoon. (If the cocoon has been infected by pathogen, it must be given up to.) The healthy cocoons were put into a rearing box of *Chouioia cunea* to obtain natural parasite.



Fig. 1 Tussah cocoon cut by Three-cut method

Another breeding method used was inoculating method, which is to artificially inoculate the eggs of *Chouioia cunea* into body of cocoon. Table drawers were usually used for inoculating. A thermometer, a cutting knife, a refrigerator,

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and rearing cabins must be ready before operation.

## Results

### Comparison of breeding methods

The parasitism rates of 95% and 49% were obtained by the "Three-cut-method" and inoculating method respectively. The parasitism number on one pupa is 5 018 for three-cut method and 2 603 for inoculating method, and the ratio of ♀:♂ is 17:3 and 5:3 respectively. Therefore, based on the experimental result, we can conclude that the "three-cut method" is a best approach to rear *Chouioia cunea*, with the advantages of easy operation, high reproduction rate and good future of exploitation. The parasitized tussah pupa is shown as Fig.2.

The best ratio of host pupa to *Chouioia cunea* is 1:10-30, the favorable temperature of breeding is in range of 24-28 °C, and the relative humidity range is 70%-80%. Under the

above conditions, 85%-100% living and parasitism rate can be obtained.

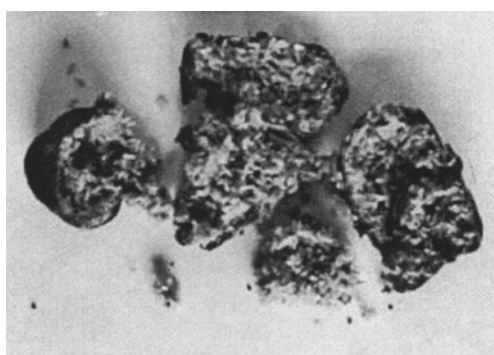


Fig. 2 Profile of parasitoid tussah pupa larvae

Table 1. Different pests tested as hosts for rearing *Chouioia cunea*

Pest	Parasitism rate /%	No. of parasite host	Host origin
<i>Hyphantria cunea</i> Drury	83	191	Dalian
<i>Dendrolimus tabulaeformis</i> Tsai et Liu	78	1010	Chaoyang
<i>Dendrolimus spectabilis</i> Butler	81	982	Changhai
<i>Yponomeuta polystigmellus</i> Felder	32	4	Shenyang
<i>Phassus excrescens</i> Butler	43	705	Shenyang
<i>Ivela ochropoda</i> (Eversmann)	47	67	Shenyang
<i>Lymantria dispar</i> L.	28	351	Shenyang
<i>Parocneria furva</i> (Leech)	21	48	Shenyang
<i>Ostrinia furnacalis</i> Guenee	41	7	Shenyang
<i>Heliothis armigera</i> Hubner	58	17	Chaoyang
<i>Antheraea pernyi guerini</i> Meneville	95	5018	Zhuanghe
Noctuidae	0	0	Shenyang
<i>Plutella xylostella</i> (L.)	30	3-7	Shenyang
Tachinidae	10	8	Shenyang
<i>Musca domestica</i>	20	7	Shenyang

### Biological characteristics

*Chouioia cunea* is a kind of parasite wasp, with four developing periods: egg, larvae, pupa, and adult. Its adults oviposit in the host pupa (Yang 1989, 1998). The mature larvae consume all the nutrients of the host pupa. The number of wasp per pupa is about 5 000, ♀:♂ = 17:3, and life span of the female wasp is 15 days at 21°C. In the natural conditions, the wasp can overwinter by larvae in mature pupa.

### Life cycle

**Egg:** The egg of *Chouioia cunea* is silver-white, shuttle type, glossiness on the surface, with a length of 0.2 mm or so. When the egg is put into the water, it looks like a small white spot (Fig.3)

**Larvae:** The 1st-instar larva from the egg is only 0.21 mm in length. The body of 2nd-instar larva is clear. 3rd-instar and 4th-instar larvae have a good appetite, and

the 5th-instar larvae consume all nutriment of tussah pupa. The 6th-instar larva is 2.7 mm in length.

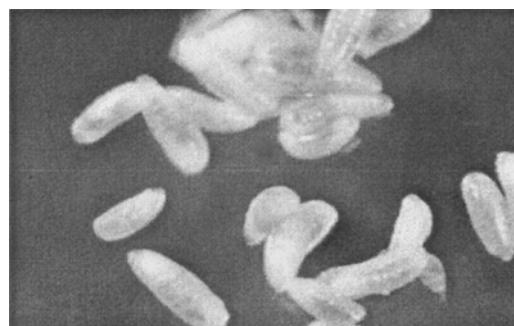
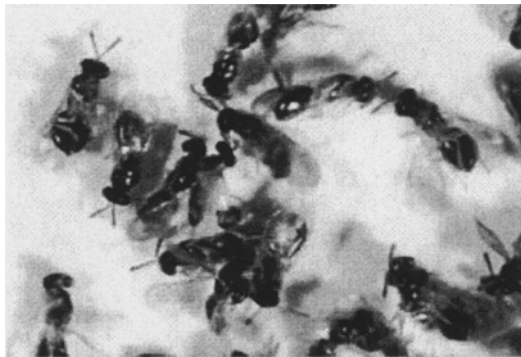


Fig. 3 Eggs of *Chouioia cunea*

**Pupa:** Pupa is white at first, and then becomes yellow, with dark stomach. After 5-6 days, pupa is dark, with white stripe on the stomach, about 1.2-1.7 mm long, and become

adult after 15-16 days.

**Adult:** The body of the male adult is dark and bigger than that of the female, and about 1.4 mm long, with grey breast and stomach, and the edge of its antenna is bigger than that of the female. (Fig.4) The female is 1.1-1.5 mm long, dark red, or bright, or other dark colors on the fore-breast and stomach, with dark yellow antenna, 3 pairs of legs and yellow mouthpart, and transparent wings.



**Fig.4 Adult of *Chouioia cunea***

### Conclusion and discussion

From the experiment, *Chouioia cunea* Yang as a natural enemy has the advantages of high parasite rate, fast reproduction speed, and so on. And now the control technique by *Chouioia cunea* has been widely applied to the heavily occurred areas of American white fallworm, such

as Liaoning, Hebei, Shandong, Shanxi provinces as well as Shanghai city.

As the development of the biological engineering technology and the wide application of biological control, IPM could be combined with biological, cultural, physical and chemical methods together to regulate pest population, to reduce the negative effects on the environment and human beings.

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